

WHAT IS CLAIMED IS:

1. A communication system using packet switching for conducting packet communication between a server and a client through a switching apparatus, wherein

said switching apparatus

5 during relay of a packet to be transmitted from said server to said client, rewrites header information of the packet in question to have the contents which are to be set when the packet in question is sent from said switching apparatus and sends said packet to said client,  
10 and

from the time of relay of a data acquisition request from said client until the end of transmission of a packet of an acknowledgement to be transmitted from said server to said client, conducts one-way splicing  
15 processing in the direction from the server in question to the client in question, as well as successively conducting retransmission control and flow control of communication in the direction from said client to said server.

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2. The communication system as set forth in claim 1, wherein

said switching apparatus comprising

a client side processing unit for accepting a  
5 connection from each said client to manage a connection

with the client in question for transmitting and receiving a packet to and from the client,

10 a server side processing unit for accessing each said server to manage a connection with the server in question for transmitting and receiving a packet to and from the server,

15 means for, during relay of a packet to be transmitted from said server to said client, rewriting header information of said packet to send said packet rewritten to said client, and

20 means for conducting one-way splicing in the direction from said server to the client in question, as well as successively conducting retransmission control and flow control for communication in the direction from said client to said client side processing unit and communication in the direction from said server side processing unit to said server without cutting off an established connection.

3. The communication system as set forth in claim 2, wherein

5 said client side processing unit including a client side terminating unit for controlling a connection with each said client to accept a connection and a request from each said client, and

a client side updating unit for rewriting header information of a packet to be transmitted from said

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server to said client to relay the rewritten packet, and  
10           said server side processing unit including  
            a server side terminating unit for managing a  
connection with each said server to relay an instruction  
and data directed to each said server which are sent  
from said client side terminating unit, and  
15           a server side updating unit for accepting a  
packet to be transmitted from each said server to each  
said client to send the packet to said client side  
updating unit.

4.       The communication system as set forth in claim 3,  
wherein  
          header information of said packet including  
          a sequence number indicative of, in transmission  
5       data divided into individual packets, order of data in a  
packet in question,  
          a data length of the packet in question, and  
          an Ack number indicative of a sequence number of  
data that a communication partner has already received.

10       5.       The communication system as set forth in claim 4,  
wherein  
          header information of said packet further  
includes  
5       a Win value indicative of a remaining capacity of  
a reception buffer that the communication partner is yet

to receive.

6. The communication system as set forth in claim 2,  
wherein

said client side terminating unit including  
means for notifying header information of a  
5 packet received from each said client to said client  
side updating unit and said server side terminating unit,  
and

said server side updating unit including  
means for notifying header information of a  
10 packet to be transmitted from each said server to each  
said client to said server side terminating unit,  
said client side updating unit and said server  
side terminating unit

recording and referring to said notified header  
15 information to properly rewrite header information of  
the packet.

7. The communication system as set forth in claim 6,  
wherein

at a state where said one-way splicing processing  
is set, said client side terminating unit instructs  
5 said client side updating unit to conduct  
acknowledgment processing in response to a packet  
received from each said client,

said client side updating unit including

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means for receiving an instruction of said  
10 acknowledgement processing to generate and send a packet  
of an acknowledgement to the client in question.

8. The communication system as set forth in claim 2,  
wherein

said server side updating unit  
relays transmission of packets from a plurality  
5 of said servers directed to one said client, and  
includes means for removing, from header  
information of a packet to be relayed, a flag indicative  
of the end of transmission of the packet at individual  
said server,  
10 thereby relaying a packet transmitted by the  
switching of said plurality of servers to said client  
without cut-off of a connection with said client.

9. The communication system as set forth in claim 2,  
wherein

said client side terminating unit and said server  
side terminating unit including

5 means for restoring transmission data to be  
transmitted in individual divisional packets from said  
client to said server to an original state prior to the  
division to selectively transmit each packet to the  
server.

10. The communication system as set forth in claim 2,  
further comprising

an analysis unit for determining a server as a  
connection destination to which each said client  
5 connects,

said analysis unit including  
means for obtaining, from said client side  
terminating unit, information of a request sent by said  
client to each said server,

10 means for determining a server as a connection  
destination to which the client in question is to  
connect based on said request, and

means for instructing said server side  
terminating unit to connect the client in question with  
15 said server determined as a connection destination.

11. The communication system as set forth in claim 10,  
wherein

said client side terminating unit and said server  
side terminating unit including

5 means for restoring transmission data to be  
transmitted in individual divisional packets from said  
client to said server to an original state prior to the  
division and then transmitting the restored packet to  
the server in question, and

10 said analysis unit including  
means for determining said server as a connection

destination based on said transmission data restored to the original state prior to the division.

12. The communication system as set forth in claim 10, wherein

said analysis unit including

means for sequentially classifying data

5 acquisition requests yet to be processed which are issued by said client into groups according to corresponding servers as connection destinations, and

means for instructing, on each said classified group basis, said server side terminating unit to set up  
10 a connection to a corresponding server and execute said data acquisition requests classified into the group in question.

13. The communication system as set forth in claim 10, wherein

said analysis unit including

means for sequentially classifying data

5 acquisition requests yet to be processed which are issued by said client into groups according to corresponding servers as connection destinations, and

means for instructing, on each said classified group basis, said server side terminating unit to set up  
10 a connection to a corresponding server, execute said data acquisition requests classified into the group in

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question and cut off the connection with the server after the transmission of the acquisition request.

14. A switching apparatus for relaying packet communication through a communication network between a plurality of servers and clients, wherein said switching apparatus

5 during relay of a packet to be transmitted from said server to said client, rewrites header information of the packet in question to have the contents which are to be set when the packet in question is sent from the switching apparatus and sends said packet to said client,  
10 and

from the time of relay of a data acquisition request from said client until the end of transmission of a packet of an acknowledgement to be transmitted from said server to said client, conducts one-way splicing  
15 processing in the direction from the server in question to the client in question, as well as successively conducting retransmission control and flow control of communication in the direction from said client to said server.

20 15. The switching apparatus as set forth in claim 14, comprising

a client side processing unit for accepting a connection from each said client to manage a connection

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5 with the client in question for transmitting and  
receiving a packet to and from the client,

a server side processing unit for accessing each  
said server to manage a connection with the server in  
question for transmitting and receiving a packet to and  
10 from the server,

means for, during relay of a packet to be  
transmitted from said server to said client, rewriting  
header information of said packet to send said packet  
rewritten to said client, and

15 means for conducting one-way splicing in the  
direction from said server to the client in question, as  
well as successively conducting retransmission control  
and flow control for communication in the direction from  
said client to said client side processing unit and  
20 communication in the direction from said server side  
processing unit to said server without cutting off an  
established connection.

16. The switching apparatus as set forth in claim 15,  
wherein

said client side processing unit including  
a client side terminating unit for managing a  
5 connection with each said client to accept a connection  
and a request from each said client, and

a client side updating unit for rewriting header  
information of a packet to be transmitted from said

server to said client to relay the rewritten packet, and  
10           said server side processing unit including  
            a server side terminating unit for managing a  
connection with each said server to relay an instruction  
and data directed to each said server which are sent  
from said client side terminating unit, and  
15           a server side updating unit for accepting a  
packet to be transmitted from each said server to each  
said client to send the packet to said client side  
updating unit.

17.       The switching apparatus as set forth in claim 16,  
wherein  
            header information of said packet including  
            a sequence number indicative of, in transmission  
5       data divided into individual packets, order of data in a  
packet in question,  
            a data length of the packet in question, and  
            an Ack number indicative of a sequence number of  
data that a communication partner has already received.

18.       The switching apparatus as set forth in claim 17,  
wherein  
            header information of said packet further  
10       includes  
5       a Win value indicative of a remaining capacity of  
a reception buffer that the communication partner is yet

to receive.

19. The switching apparatus as set forth in claim 15,  
wherein

said client side terminating unit includes

means for notifying header information of a

5 packet received from each said client to said client  
side updating unit and said server side terminating unit,  
and

said server side updating unit includes

means for notifying header information of a

10 packet to be transmitted from each said server to each  
said client to said server side terminating unit,

said client side updating unit and said server  
side terminating unit recording and referring to said  
notified header information to properly rewrite header  
15 information of the packet.

20. The switching apparatus as set forth in claim 19,  
wherein

at a state where said one-way splicing processing  
is set, said client side terminating unit instructs

5 said client side updating unit to conduct  
acknowledgment processing in response to a packet  
received from each said client,

said client side updating unit including

means for accepting an instruction of said

10 acknowledgement processing to generate and send a packet  
of an acknowledgement to the client in question.

21. The switching apparatus as set forth in claim 15,  
wherein

said server side updating unit

relays transmission of packets from a plurality

5 of said servers directed to one said client, and

includes means for removing, from header  
information of a packet to be relayed, a flag indicative  
of the end of transmission of a packet at individual  
said server,

10 thereby relaying a packet transmitted by the  
switching of said plurality of servers to said client  
without cut-off of a connection with said client.

22. The switching apparatus as set forth in claim 15,  
wherein

said client side terminating unit and said server  
side terminating unit include

5 means for restoring transmission data to be  
transmitted in individual divisional packets from said  
client to said server to an original state prior to the  
division to selectively transmit each packet to the  
server.

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23. The switching apparatus as set forth in claim 15,

further comprising

an analysis unit for determining a server as a  
connection destination to which each said client  
5 connects,

said analysis unit including

means for obtaining, from said client side  
terminating unit, information of a request sent by said  
client to each said server,

10 means for determining a server as a connection  
destination to which the client in question is to  
connect based on said request, and

means for instructing said server side  
terminating unit to connect the client in question with  
15 said server determined as a connection destination.

24. The switching apparatus as set forth in claim 23,  
wherein

said client side terminating unit and said server  
side terminating unit include

5 means for restoring transmission data to be  
transmitted in individual divisional packets from said  
client to said server to an original state prior to the  
division and then transmitting the restored packet to  
the server in question, and

10 said analysis unit includes

means for determining said server as a connection  
destination based on said transmission data restored to

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25. The switching apparatus as set forth in claim 23,  
wherein

means for sequentially classifying data

means for instructing, on each said classified group basis, said server side terminating unit to set up a connection to a corresponding server and execute said data acquisition requests classified into the group in question.

26. A packet switching method of a switching apparatus for relaying packet communication through a communication network between a plurality of servers and clients, comprising the steps of:

during relay of a packet to be transmitted from said server to said client, rewriting header information of the packet in question to have the contents which are to be set when the packet in question is sent from the switching apparatus and sending said packet to said client, and

from the time of relay of a data acquisition  
request from said client until the end of transmission

of a packet of an acknowledgement to be transmitted from said server to said client, conducting one-way splicing processing in the direction from the server in question to the client in question, as well as successively conducting retransmission control and flow control of communication in the direction from said client to said server.

27. The packet switching method as set forth in claim 26, further comprising the steps of

managing a connection with each said client to accept a connection and a request from each said client, rewriting header information of a packet to be transmitted from said server to said client to relay the rewritten packet, and

managing a connection with each said server to relay an instruction and data directed to each said server which are sent from said client, wherein

header information of said packet includes:

a sequence number indicative of, in transmission data divided into individual packets, order of data in a packet in question,

a data length in and below a transport layer of the packet in question,

an Ack number indicative of a sequence number of data that a communication partner has already received, and

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5

determining a server as a connection destination



to which the client in question is to connect based on said request, and

giving an instruction to connect the client in question with said server determined as a connection destination,

thereby determining a server as a connection destination to which each said client is to connect.

31. The packet switching method as set forth in claim 30, further comprising the steps of

sequentially classifying data acquisition requests yet to be processed which are issued by said client into groups according to corresponding servers as connection destinations, and

giving an instruction, on each said classified group basis, to set up a connection to a corresponding server and execute said data acquisition requests classified into the group in question.

32. A switching program for relaying packet communication through a communication network between a plurality of servers and clients by the control of a computer, comprising the functions of

during relay of a packet to be transmitted from said server to said client, rewriting header information of the packet in question to have the contents which are to be set when the packet in question is sent from said

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switching apparatus and sending said packet to said  
client, and

from the time of relay of a data acquisition  
request from said client until the end of transmission  
of a packet of an acknowledgement to be transmitted from  
said server to said client, conducting one-way splicing  
processing in the direction from the server in question  
to the client in question, as well as successively  
conducting retransmission control and flow control of  
communication in the direction from said client to said  
server.

33. The switching program as set forth in claim 32,  
further comprising the functions of

managing a connection with each said client to  
accept a connection and a request from each said client,  
rewriting header information of a packet to be  
transmitted from said server to said client to relay the  
rewritten packet, and

managing a connection with each said server to  
relay an instruction and data directed to each said  
server which are sent from said client, wherein

header information of said packet including  
a sequence number indicative of, in transmission  
data divided into individual packets, order of data in a  
packet in question,

a data length in and below a transport layer of

the packet in question,

an Ack number indicative of a sequence number of data that a communication partner has already received, and

20 a Win value indicative of a remaining capacity of a reception buffer that the communication partner is yet to receive.

34. The switching program as set forth in claim 33, further comprising the functions of

relaying transmission of packets from a plurality of said servers directed to one said client, and

5 removing, from header information of a packet to be relayed, a flag indicative of the end of transmission of a packet at individual said server,

10 thereby relaying a packet transmitted by the switching of said plurality of servers to said client without cut-off of a connection with said client.

35. The switching program as set forth in claim 33, further comprising the function of

5 restoring transmission data to be transmitted in individual divisional packets from said client to said server to an original state prior to the division to selectively transmit each packet to the server.

36. The switching program as set forth in claim 33,

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further comprising the functions of

obtaining information of a request to be  
transmitted by said client to each said server,

5 determining a server as a connection destination  
to which the client in question connects based on said  
request, and

10 giving an instruction to connect the client in  
question with said server determined as a connection  
destination,

thereby determining a server as a connection  
destination to which each said client is to connect.

37. The switching program as set forth in claim 36,  
further comprising the functions of

15 sequentially classifying data acquisition  
requests yet to be processed which are issued by said  
client into groups according to corresponding servers as  
connection destinations, and

20 give an instruction, on each said classified  
group basis, to set up a connection to a corresponding  
server and execute said data acquisition requests  
classified into the group in question.

38. A switching program operating on a server in a  
communication system for conducting packet communication  
between a server and a client through a switching  
apparatus by the control of a computer on the server,

5 comprising the function of,  
from the time of relay of a data acquisition  
request from said client by said switching apparatus  
until the end of transmission of a packet of an  
acknowledgement to be transmitted to said client,  
10 transmitting said packet to the client in question by  
one-way splicing.

39. A switching program operating on a client in a  
communication system for conducting packet communication  
between a server and a client through a switching  
apparatus by the control of a computer on the client,  
5 comprising the function of,

from the time of relay of a data acquisition  
request to said server by said switching apparatus until  
the end of transmission of a packet of an  
acknowledgement to be received from said server,  
10 receiving said packet from the server in question by  
one-way splicing.

40. A server in a communication system for conducting  
packet communication between a server and a client  
through a switching apparatus, wherein

from the time of relay of a data acquisition  
5 request from said client by said switching apparatus  
until the end of transmission of a packet of an  
acknowledgement to be transmitted to said client, said

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server transmits said packet to the client in question  
by one-way splicing.

10 41. The server as set forth in claim 40, wherein  
to said client, said server transmits said packet  
with header information rewritten to have the contents  
to be set when the packet in question is transmitted  
5 from said switching apparatus.

42. The server as set forth in claim 41, wherein  
header information of said packet including  
a sequence number indicative of, in transmission  
data divided into individual packets, order of data in a  
5 packet in question,  
a data length of the packet in question, and  
an Ack number indicative of a sequence number of  
data that a communication partner has already received.

43. The server as set forth in claim 42, wherein  
header information of said packet further  
includes  
a Win value indicative of a remaining capacity of  
5 a reception buffer that the communication partner is yet  
to receive.

44. The server as set forth in claim 41, wherein  
said switching apparatus relays transmission of

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packets from a plurality of said servers directed to one said client, and

5           from header information of a packet to be relayed, a flag is removed which is indicative of the end of transmission of a packet at individual said server, thereby relaying a packet transmitted by the switching of said plurality of servers to said client  
10           without cut-off of a connection with said client.

45.       The server as set forth in claim 41, wherein transmission data to be transmitted in individual divisional packets from said client is restored to an original state prior to the division, whereby each  
5       packet restored is received by a selected server.

46.       The server as set forth in claim 41, wherein a server as a connection destination to which each said client is to connect is determined by said switching apparatus,

5           information of a request to be transmitted by said client to each said server is obtained by said switching apparatus, a server as a connection destination to which the client in question is to connect is determined based on  
10       said request, and

          an instruction to connect the client in question with said server determined as a connection destination

is given.

47. The server as set forth in claim 46, wherein  
data acquisition requests yet to be processed  
which are issued by said client are sequentially  
classified into groups as set forth in corresponding  
5 servers as connection destinations, and

on each said classified group basis, an  
instruction is given to set up a connection to a  
corresponding server and execute said data acquisition  
requests classified into the group in question.

48. A client in a communication system for conducting  
packet communication between a server and a client  
through a switching apparatus, wherein

from the time of relay of a data acquisition  
5 request to said server by said switching apparatus until  
the end of transmission of a packet of an  
acknowledgement to be received from said server, said  
client receives said packet from the server in question  
by one-way splicing.

49. The client as set forth in claim 48, wherein  
said client receives from said server, said  
packet with header information rewritten to have the  
contents to be set when the packet in question is  
5 transmitted from said switching apparatus.



50. The client as set forth in claim 49, wherein  
header information of said packet including  
a sequence number indicative of, in transmission  
data divided into individual packets, order of data in a  
packet in question,

a data length of the packet in question, and  
an Ack number indicative of a sequence number of  
data that a communication partner has already received.

51. The client as set forth in claim 50, wherein  
header information of said packet further  
includes  
a Win value indicative of a remaining capacity of  
a reception buffer that the communication partner is yet  
to receive.

52. The client as set forth in claim 49, wherein  
said switching apparatus relays transmission of  
packets from a plurality of said servers directed to one  
said client, and

from header information of a packet to be relayed,  
a flag is removed which is indicative of the end of  
transmission of a packet at individual said server,  
thereby relaying a packet transmitted by the  
switching of said plurality of servers to said client  
without cut-off of a connection with said client.

53. The client as set forth in claim 49, wherein  
transmission data to be transmitted in individual  
divisional packets from said client is restored to an  
original state prior to the division and each packet  
restored is transmitted to a selected server.

54. The client as set forth in claim 49, wherein  
a server as a connection destination to which  
each said client is to connect is determined by said  
switching apparatus,

information of a request to be transmitted by  
said client to each said server is obtained by said  
switching apparatus,

a server as a connection destination to which the  
client in question is to connect is determined based on  
said request, and

an instruction to connect the client in question  
with said server determined as a connection destination  
is given.

55. The client as set forth in claim 54, wherein  
data acquisition requests yet to be processed  
which are issued by said client are sequentially  
classified into groups according to corresponding  
servers as connection destinations, and  
on each said classified group basis, an

instruction is given to set up a connection to a corresponding server and execute said data acquisition requests classified into the group in question.

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